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Green Fleet Strategic Plan Development

Phase I Report

Submitted by Clean Fuels Ohio
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CleanFuelsOhio

city of CINCINNATI

Introduction – City of Cincinnati Green Fleet Strategic Plan Development

The City of Cincinnati seeks to develop a plan for "greening" the City's fleet over the next several years and has contracted Clean Fuels Ohio (CFO) to assist with this process. The City has consolidated data and conducted useful analysis in pursuit of these efforts. The City is interested in a comprehensive, detailed plan developed in two distinct phases:

- During Phase I, between late-October and mid-November, a conceptual level plan will be developed, summarizing the status of the current fleet and providing a conceptual framework for achieving fleet goals. This framework will lay out multiple management strategies, vehicle fuel alternatives, and technology options for detailed analysis during the next planning phase.
- Phase II will include a detailed examination of vehicle and fuel options along with additional financial and management strategies designed to achieve the City's goals. In addition, Phase II will outline a detailed implementation schedule over the 13-year period to ensure fleet success.

This report, prepared by Clean Fuels Ohio in collaboration with the City of Cincinnati Department of Public Services and Office of Environmental Quality, details Phase I as outlined above.

Clean Fuels Ohio's Green Fleet consulting and reporting services are designed to significantly improve the environmental performance and fuel efficiency of public and private fleets by providing:

- Direct consultation with fleet managers to develop a Green Fleet management plan tailored to specific organizational needs.
- Hands on support and assistance with implementation, including assistance seeking grant funding to reduce implementation costs.
- Recognition of environmental leadership through a Five-Star rating system that scores fleets based on measurable reductions in vehicle emissions and improvements in efficiency.

Clean Fuels Ohio is fuel and technology-neutral. We work with fleets on an individual basis to help determine the strategy, or combination of strategies, that best meet individual organizational goals. Clean Fuels Ohio would like to thank the City of Cincinnati personnel who have contributed information, data, and guidance to this report, particularly the Deputy Director of the Department of Public Services, Maraskeshia Smith and her staff and the Office of Environmental Quality, Director Larry Falkin.

Current Performance Indicators – City of Cincinnati Fleet

Clean Fuels Ohio has analyzed the City of Cincinnati's fleet and identified 14 key indicators that provide a summary of the fleet's operating parameters. These Key Performance Indicators (KPIs) are designed to provide a baseline overview of Cincinnati's current fleet operations, as well as a context for the recommendations outlined in the report that follows. The KPIs below include metrics such as total unit counts, average age/model year, efficiency, fuel usage, capital costs, repair costs, and life cycle information.

Key Performance Indicator:	Cincinnati Fleet Analysis:
1. *Total Vehicles and Equipment*	**3,654** units
a. *On-Road Vehicles*	**1,812** units (***avg. MY 2005***)
b. *Off-Road Vehicles & Equipment*	**1,842** units (***avg. MY 2003***)
2. *Fleet Average Age*	**7** years
3. *Fleet Median Fuel Efficiency (all units)*	**12.15 MPG** (removing outliers < 4 MPG / > 46 MPG)
4. *Fleet Annual Fuel Usage (Total 2010)*	**2,048,033** gallons (***Avg. 12.15 MPG***)
a. *Gasoline*	**1,165,138** gallons (***Avg. 14.88 MPG***)
b. *Diesel*	**791,336** gallons (***Avg. 5.7 MPG***)
c. *Ethanol (E85)*	**87,210** gallons (***Avg. 21 MPG***)
d. *Propane (2011 YTD))*	**29,288.8** gas gallon equivalents (***Avg. 11 MPG***)
5. *Total Annual Fuel Costs (2010 YTD)*	**$5,128,903**
6. *Capital Investment Costs*	**$99,008,475.04**
7. *Life to Date Repairs*	**$49,850,222.07**
8. *Annual Maintenance & Repair Costs*	**$5,864,595.51**
9. *Excessive Repairs (based on current city definitions)*	**$8,247,283.34**
10. *Units Out of Life Cycle (based on current city life cycle policies)*	**~ Half of all Vehicles**
11. *Projected Cost of Replacement (based on original equipment values)*	**~ $50,000,000**
12. *Capital Replacement Budget (FY 2012)*	**$5,240,600** (All departments)
**Note: All KPI's based on annual and life to date data collected by City of Cincinnati personnel.* ***All Data 2011 year to date thru September except where noted.*	

Making improvements to each of these categories can assist in stabilizing fleet operating and capital budgets and in reducing cost "spikes" from year to year. The recommendations outlined in the report below are designed help improve these performance indicators, with specific focus on minimizing operational and fuel costs, improving efficiency, and bringing the fleet into lifecycle by incorporating more alternative fuel and fuel efficient vehicles.

Fleet Management Goals – Greening the City Fleet:

The City of Cincinnati has provided Clean Fuels Ohio with documents and data that outline a set of broad goals for greening fleet operations. The City has consolidated data and conducted useful analysis in pursuit of these efforts. The City is also pursuing alternative fuels such as propane as a sub-recipient in Clean Fuels Ohio's US Dept. of Energy Clean Cities grant. The following three goals have been articulated by the City in its current draft plan:

Greening the City Fleet – Current City Goals:
1. *Within 5 years, have all vehicles replaced when they reach the end of their life expectancy.*
2. *By 2025, eliminate the use of gas and diesel as motor fuels, replacing it with cleaner, more sustainable alternatives.*
3. *Minimize financial costs to the City related to fleet operations.*

While Clean Fuels Ohio broadly agrees with these three internal management goals, several points bear mentioning. First, Clean Fuels Ohio recommends replacing vehicles at appropriate intervals to minimize fleet repair costs and maximize performance and efficiency. However, CFO also recommends improvements in the City's current life-cycle assessment procedures and replacement criteria which, if implemented, would change the current mix of vehicles classified as beyond life expectancy (see vehicle right-sizing recommendations 1-3).

Second, it is unlikely that the City will find it cost effective to completely eliminate all gasoline and diesel fuels from its operations by 2025. Though more alternative fuel products are coming to market every quarter, and the majority of the City's current vehicles have the potential to be operated on alternative fuels, it is likely that the most cost effective management scenarios will still involve gasoline and diesel fuels for certain equipment and applications.

Finally, we recognize that city governments must balance immediate fiscal constraints with long-term environmental and public service goals. With this in mind, the recommendations in the report below have been specifically designed to help minimize the costs associated with City fleet operations.

Strategic Direction – Making Goals a Reality:

Based on past guidance issued by the City Council, and initial discussions with the Director of the Office of Environmental Quality and the Deputy Director of Public Services, Clean Fuels Ohio recommends the following strategic direction to guide the City of Cincinnati's Green Fleet plan development:

Strategic Direction – Top Five Priorities:
1. *Reduce the current fleet size and develop a regular review process to ensure the City's fleet is appropriately sized in relation to staffing, equipment utilization, and service demands.*
2. *Explore alternatives to traditional vehicle ownership including leasing and car-sharing models.*
3. *Acquire energy efficient and alternative fuel vehicles and off-road equipment whenever the lifecycle cost (including all available subsidies) is less than the lifecycle cost of conventional vehicles.*
4. *Improve fleet tracking metrics, data gathering, and review. Establish baselines around fleet efficiency, vehicle miles travelled, emissions, and green technology deployed to track progress over time.*
5. *Improve policies and procedures in order to move to a more proactive fleet management model.*

Key Recommended Actions – Executive Summary:

The following recommendations for further action are based on the Clean Fuels Ohio's review and assessment of data supplied, and current Key Performance Indicators. These summary recommended actions are designed to provide a conceptual framework for achieving fleet goals. This framework lays out multiple management strategies, vehicle fuel alternatives, and technology options that are explored in further detail in the following analysis. These strategies are all oriented around near and long term cost savings that can be realized in the City's fleet operations.

10 Key Recommended Actions:
1. *Create Right-Sizing Policies and Procedures for all new vehicle and equipment acquisitions.*
2. *Conduct a detailed fleet vehicle utilization study and develop a process for regular review.*
3. *Reduce fleet size to match current staffing levels and overall operational needs.*
4. *Create new procedures to establish vehicle life-cycle and replacement schedules that will maximize useful life of equipment while reducing operational and maintenance costs.*
5. *Develop procedures to track and eliminate unnecessary vehicle idling including:* a. *Creation of a clear tracking system* b. *Development of Idle Reduction Training Program for Equipment Operators* c. *Deployment of cost effective technologies such as GPS tracking systems, engine timers, auxiliary power systems, and automatic engine shutdown devices.*
6. *Improve driver behavior and vehicle maintenance regimes by:* a. *Adopting training programs focused on improving fuel conservation and equipment longevity.* b. *Deploying comprehensive driver tracking and review procedures* c. *Exploring incentive and recognition systems to reward best practices*
7. *Apply standard models and pay-back calculations to determine the feasibility of other vehicle and equipment options beside traditional ownership models:* a. *Explore leasing, car-sharing, vehicle rental, and personal vehicle reimbursements.* b. *Issue competitive request for proposals around each option to determine the real world cost effectiveness of deploying each option in city operations.*
8. *Acquire energy efficient and alternative fuel vehicles whenever the lifecycle costs (including all available subsidies) are less than the lifecycle cost of conventional vehicles.* a. *Explore fuel hedging options in Phase II of the planning process to guard against price volatility.* b. *Use life-cycle costs to select the most energy efficient vehicle in acquisition process.* c. *Expand use of propane vehicles for light and medium duty applications whenever feasible.* d. *Replace lawn and maintenance equipment with propane options whenever feasible.* e. *Conduct detailed study of the total costs of CNG vehicle and station project costs and savings during Phase II of the green fleet strategic plan development process.* f. *Expand the use of cost effective hybrid and electric drive vehicles in city operations.*
9. *Pursue state and federal incentives, subsidies, grant programs, and other incentives to help reduce the implementation costs of strategies and technologies outlined in this report.*
10. *Develop a green fleet strategic plan outlining a detailed implementation schedule over short, medium, and long-term timeframes to ensure fleet success.*

Detailed Analysis – Exploring Fleet Management Options:

Vehicle Right Sizing:

Right-sizing refers to minimizing the miles travelled of over-sized or unnecessarily heavy vehicles in a fleet. Replacing heavier, less fuel efficient vehicles with lighter, more efficient options capable of achieving the same service functions can often achieve significant fuel economy improvements. The basic fuel economy benefits of rightsizing vehicles to smaller classes are displayed in the table below.

Fuel Economy Effect of Truck Class Downsizing[1]

Truck class	GVWR range	Average Efficiency (mpg)	Rightsizing Benefits (mpg gains)
7-8b	26,001 – 33,000	6.4	N/A (Highest Class Vehicles)
6	19,501 – 26,000	7.0	9% (from class 7)
5	16,001 – 19,500	7.9	13% (from class 6)
4	14,001 – 16,000	8.5	8% (from class 5)
3	10,001 – 14,000	10.5	24% (from class 4)

In addition to rightsizing medium and heavy duty units, significant efficiency and environmental benefits can be achieved even by acquiring more light duty models. The table below details the benefits of replacing Dodge Avenger and Ford Taurus models currently deployed in the City's fleet with a highly efficient vehicle like the Chevy Cruze.

Vehicle	Annual Fuel Use	Annual Electricity Use	Annual Fuel/Elec Cost	Annual Operating Cost	Cost Per Mile	Annual Emissions (lbs CO2)
2011 Chevrolet Cruze Eco Gasoline	383 gal	0 kWh	$1,294	$3,552	$0.30	9,190
2011 Dodge Avenger Gasoline	479 gal	0 kWh	$1,618	$3,876	$0.32	11,490
2011 Ford Taurus FWD Gasoline	531 gal	0 kWh	$1,795	$4,053	$0.34	12,746

Based on Clean Fuels Ohio's analysis of the City of Cincinnati's fleet procurement procedures, no formalized policy exists to ensure that new vehicle purchases are appropriately sized to specific work applications or to maximize efficiency. Therefore, we recommend the following action:

Key Recommended Action: ***Create Right-Size Policy for New Vehicle Purchases***

1. ***Create an official, regularly reviewed, and enforceable management policy to ensure newly acquired vehicles are right sized to their particular task and function. Vehicles should be the right size considering passengers, storage capacity and work related functions they will perform.***

[1] *Greenhouse Gas Management for Medium-Duty Truck Fleets*. Environmental Defense Fund, 2010. Web. 1 Apr. 2010. <http://edf.org/documents/10860_fleets-med-ghg-management.pdf>.

Fleet Down-Sizing:

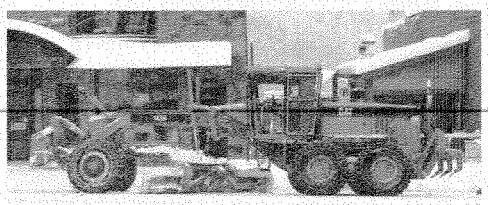
Beyond the benefits of right sizing particular vehicles to their specific tasks, an entire fleet can be downsized to ensure that the total number of vehicles and their makeup is appropriate for the level of staffing and utilization demanded by fleet customers. In the fleet management business, periodic utilization reviews and rightsizing or downsizing studies can pay for themselves many times over in increased productivity and lower operating and capital costs.

Evaluating size and usage patterns of fleet assets should always be done in the context of an organization's mission, the types of functions performed and the levels of service required. The City of Cincinnati's vehicles and equipment are used to perform routine and emergency functions that keep the City running. However, the City cannot and should not make a vehicle accessible to each employee who requires one to perform his or her job function. Management should provide access to equipment when it is needed, for the duration required, and at a reasonable cost. A comprehensive fleet management strategy requires optimizing use of all viable transportation alternatives including permanently assigned vehicles, short-term rentals from motor pools, commercial rentals, short-term leases, reimbursement for use of personally owned vehicles (POV) and other forms of transportation.

Case Study: Fleet Downsizing by Utilizing Existing Vehicles for Snow Removal

In any climate where ice and snow can accumulate during winter months, cities must maintain an active fleet of snow removal equipment. Even in areas where snowfall is relatively limited, like the Cincinnati metro area, city governments have traditionally maintained a fleet of equipment largely utilized only during winter weather events. Maintaining equipment only for limited or peak events, such as winter storms, can lead to unnecessary fleet maintenance and capital costs.

Recognizing the need to minimize these costs, many fleets are utilizing existing vehicles to perform specialized, limited functions, such as snow removal. Even in large cities with regular snowfall, like New York, existing vehicles (including refuse trucks and off-road equipment) are used for snow removal as pictured to the right.



- ***Eliminating vehicles dedicated for specialized functions like as snow removal and utilizing existing vehicles for the same task is an excellent way to reduce overall fleet size and costs.***

Successful fleet size management requires close collaboration between fleet users, who can articulate how vehicles and equipment help them do their jobs; and fleet managers, who have technical expertise

and access to fleet-wide data that individual users and departments lack. Furthermore, it is better to use guidelines (rather than thresholds) that are designed to reflect the individual work patterns of each user or department. Such guidelines allow the program to be flexible enough to accommodate unique operational requirements that cannot be met by means of alternative vehicle provisions. However, such guidelines still provide a method to trigger further investigation of vehicles that may not be needed based on the levels of utilization compared to the guideline.

Even for the best managed fleet operations a periodic rightsizing or downsizing study will usually uncover vehicles and other assets that are simply no longer needed. Therefore, Clean Fuels Ohio recommends the City conduct a detailed fleet utilization study. The utilization review and rightsizing study ranks as one of the best practices that a fleet manager can employ. Combining these studies with realistic assignment justification procedures and clear guidelines for vehicle utilization will help ensure cost control and consistently high productivity for your fleet operations.

Key Recommended Action: *Conduct Detailed Fleet Utilization/Downsizing Study*

2. ***Conduct a detailed fleet utilization study in order to develop utilization guidelines, vehicle review policies, and elimination procedures.***
    a. ***Utilization Guidelines*** –Create detailed usage guidelines (miles and hours) around each vehicle class in the city's fleet. A common best practice is to assess the mean annual usage for each class of vehicles in a fleet and target any vehicles for elimination that fall below 50% of a given class average. For instance, if the mean annual usage for sport utility vehicles (SUV) is 9,479 miles per year, any vehicle in the SUV class that has an average annual mileage below 50 percent (4,740) of the class average should be targeted for elimination.
    b. ***Vehicle Review Policies*** – Create a detailed survey to obtain additional information on each vehicle in the fleet and to help decide whether the individual vehicles whose usage falls below guidelines (i.e. 50% of the class average) should be retained or eliminated from the fleet.
        - Review use of existing vehicles for limited special functions like snow removal.
    c. ***Elimination Procedures*** – Develop an elimination policy and negotiate the final disposition of the vehicles deemed under-utilized through resale or scrappage.

Based on current data collected by the City as well as recent reductions in personnel levels, it is clear that the City can immediately reduce the size of its fleet assets by approximately eight percent across all departments. The City's current utilization policy states that all vehicles must meet a basic minimum utilization threshold of 350 miles or 24 hours a month (4,200 miles per year or 288 hours per year). Vehicles must reach these minimum criteria for three consecutive months or individual departments need to provide justification for retaining vehicles in their operations.

Based on information supplied by the City of Cincinnati's Office of Budget & Evaluation, there has been a 10% reduction in General Fund positions city-wide since 2009 and an 8% reduction in All Funds positions. Based on preliminary analysis by the Department of Public Services, as well as data reviews by Clean Fuels Ohio, we recommend the following conservative vehicle count reductions be implemented immediately to help reduce overall fleet operations and maintenance costs.

Key Recommended Action: *Reduce Fleet Size to Match Current Staff Levels*

3. ***Based on reductions in staffing levels and data supplied by the City Manager's Office and Department of Public Services, we recommend immediately eliminating the following number of vehicles from the City fleet:***

ALL DEPARTMENTS (1812 On-Road Units)	
All Fleet Divisions and Departments	**# Vehicles Targeted for Immediate Elimination**
TOTAL	154

Vehicle Life-Cycle and Replacement Policies:

Leading fleets across the nation identify units for replacement based on defensible replacement criteria and procedures. Currently, the City of Cincinnati uses basic threshold criteria for determining vehicle life-cycle and replacement considerations. The table below shows the general guidelines currently used by the City to assess vehicle replacement eligibility:

Current City Replacement Consideration Criteria:		
TYPE OF VEHICLE	TYPICAL YEAR LIFE	TYPICAL MILES LIMITS
Administrative Cars	6	60,000
Police Beat cars	4	100,000
Pick-Up Trucks	7	70,000
Vans	7	70,000
Medium Duty Trucks	10	100,000
Heavy Duty Trucks	10	100,000
Rear Loaders	7	100,000
Construction Equipment	20	----------
Small Equipment (Mowers)	3	----------
Motorcycles	5	----------
Pumpers & Aerials	10	100,000

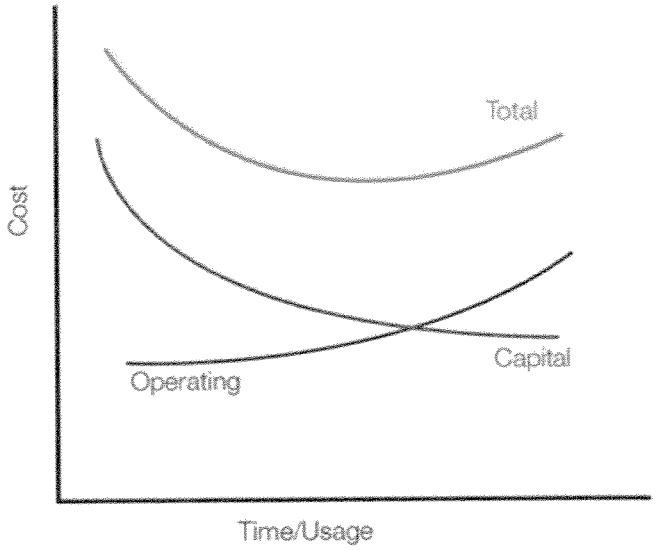
The Department of Public Services recognizes the limitations of the City's current life-cycle criteria and is in the process of developing a new structure. Clean Fuels Ohio strongly endorses this action and recommends the creation of a point-based system for replacement based on relevant data. Such point based systems have helped many fleets identify potential replacement units. By assigning values to age, use (miles or hours), type of service, reliability, historical preventative and corrective maintenance costs, as well as current vehicle condition, fleets can create a priority replacement list. Fleets utilizing such priority replacement calculations ensure that older, less cost effecting and more-polluting vehicles are taken out of service at the right time. Striking the balance between operational needs and fleet composition is critical to minimizing costs and maximizing efficiency.

Deciding on vehicle replacement can be challenging. Ideally, a unit should be replaced when the capital cost curve (decreasing over time) and operating cost curve (increasing over time) are minimized, as shown in the graph below. As the graph shows, over time, total capital costs associated with a vehicle

decrease, while total operating costs increase due to maintenance and other issues. The point at which total operating costs equal total capital costs is the optimal time to replace a vehicle. This is the point at which total cost of ownership is minimized[2].

Based on our review of City of Cincinnati procedures and industry best practices, we recommend creating a detailed point system to prioritize vehicle life-cycle and replacement decisions. Such a system should be a focus of the second phase of the City's Green Fleet Strategic Plan development process.

Economic Theory of Replacement



Key Recommended Action: *Create More Detailed Replacement Criteria and Policies*

4. ***Create new procedures to more accurately determine vehicle life-cycle and replacement schedules.***
   - ***a. Assign values to key metrics including:*** age, use (miles or hours), type of service, reliability, maintenance costs, and current vehicle condition
   - ***b. Develop a Replacement Formula:*** calculate point where total cost of ownership is minimized.
   - ***c. Develop Multi-Year Replacement Plan:*** within 5 years, have all vehicles replaced when they reach the end of their life expectancy.

Idle Reduction—Tracking, Training & Technology:

Reducing fuel use from idling cuts fleet costs and reduces all types of pollution. Based on the high cost of diesel fuel today, idle reduction technologies and behavioral policies usually offer quick and significant paybacks on costs. Every hour of vehicle idling wastes between 0.58 – 1.18 gallons of fuel.[3]

Understanding why a vehicle is idling is the key to its effective elimination, and multiple tracking and technology solutions are available help with such assessments. For example, do vehicles idle to keep operators comfortable and to provide electrical power? An auxiliary power unit, or cab heater may provide solutions. Do vehicles idle in cold weather to warm engines and other systems? Engine pre-heaters may eliminate this cause of idling. Do vehicles idle to operate hydraulic lifts and other peripheral equipment? Do operators idle to keep warm while waiting or taking a lunch break? Automatic engine

[2] Mercury Associates, Inc. 2007, pp. 24, 27, 28, 29, 42. Federation of Canadian Municipalities, *Enviro Fleets: Reducing Heavy Duty Vehicle Emissions, A Guide to Best Practices*, November 2010, pp. 10-12.

[3] United States. Environmental Protection Agency. Office of Transportation and Air Quality. *Study of Exhaust Emissions from Idling Heavy-Duty Diesel Trucks and Commercially Available Idle-Reducing Devices*. By Han Lim. Oct. 2002. Web. 1 Apr. 2010. <http://www.epa.gov/otaq/retrofit/documents/r02025.pdf>.

shutdown devices and other technologies may offer solutions. Or does idling occur simply based on myth or habit? No matter what the reason for idling, education and driver training will need to be part of the solution. The table below shows diesel emission and fuel use reductions from heavy duty vehicles using common idle reduction technology solutions.

Reduction from Typical Diesel Baseline Emissions and Fuel Use				
	PM	**NO_2**	**CO_2**	**Annual Gallons Diesel Saved (% of total)**
Auxiliary Power Unit (APU) *	27.8%	19.2%	5.9%	934 (5.9%)
Direct Fired Heater/ Pre-Heater **	23.3%	24.7%	5.4%	93 (5.4%)
On-board idle shutdown ***	.9%	.7%	1.7%	288 (1.7%)

** Based on typical long-haul, class 8a usage (2005 model year, 100,000 miles per year, 2000 annual idling hrs reduced by 1600 hrs, .58 gallons/idling hr, 6 mi/gal)*

*** Based on typical school bus usage (2005 model year, 12,000 miles per year, 360 annual idling hrs reduced by 200 hrs, .47 gallons/idling hr, 7 mi/gal)*

***** Based on typical long-haul, class 8a usage (2005 model year, 100,000 miles per year, 2000 annual idling hrs reduced by 360 hrs, .58 gallons/idling hr, 6 mi/gal)*

The case study below demonstrates real world idle reduction savings realized by the City of Columbus.

Case Study: City of Columbus Refuse Truck Hydraulic Heater Retrofits

The City of Columbus Refuse Division operates approximately 170 refuse trucks. When temperatures drop below 20 degrees Fahrenheit, these trucks must be started up to 4 hours prior to the beginning of the first refuse shift in order for the engines and interiors to be sufficiently warm to begin their routes. Based on weather data from the past three years, temperatures fell below 20 degrees an average of 37 times per year. Exhaust emission levels produced in cold temperatures are several times higher than the emissions produced at standard operating temperature.

In order to reduce warm-up time, which in turn reduces excessive fuel consumption, idle time, emissions, particulate matter and overtime costs, the Fleet Management Division retrofitted 21 refuse trucks not stored indoors with a small engine hydraulic heater. These hydraulic heaters not only preheat the engine and interior, but also truck hydraulics and engine fluid. Preheating eliminates cold starts which cause wear and tear on truck engines. The installation of these hydraulic heaters also reduces idle time, allowing refuse vehicles to better adhere to the City's Vehicle Idling and Fuel Conservation Conduct policies. The table below details the costs and benefits involved with this project. Ultimately, the City of Columbus received a grant from the US EPA to cover the costs of this project, allowing them to immediately realize cost savings. However, even without subsidies, payback for such technologies is within the typical refuse vehicle life-cycle as detailed below.

Case Study: City of Columbus Hydraulic Heater Cost & Benefit Results						
# of Units Retrofitted	**PM**	**NO_2**	**CO_2**	**Annual Avg. Idling Hours Reduced**	**Annual Gallons Diesel Conserved and Costs Savings***	**Total Project Cost**
21 Refuse Trucks	62%	4%	15%	2,331	1,172 gal. ($5,8476)	$68,271

**Fuel use savings based on 1 gallon/hour average heavy duty idling fuel use; cost savings based on $3.30 average diesel fuel.*

As indicated by the City of Columbus case study, even the most well managed fleets can identify opportunities to further reduce vehicle idling and save on operational costs. Industry best practices demonstrate that targeting vehicles with long operational hours, high fuel use, or peripheral equipment often offer the quickest return on investment when technology solutions are deployed. No matter how significant the technologies deployed or the organizational policies put in place, tracking and training will be necessary to realize the maximum benefits for any idle reduction program. Current technologies offer a range of solutions for tracking, from basic engine timers to comprehensive GPS and telematic solutions. Whatever the tracking strategy deployed, the best results will come from a combination of data, performance reviews and training.

Based on information on current practices supplied from the City of Cincinnati's Office of Environmental Quality and Department of Public Services, it is clear that the City does not currently track any vehicle idling times, nor do any departmental fleet administrators have even basic assessments of average vehicle idling times. While a formal idle reduction policy has been adopted by City Council, the lack of idle reduction tracking, training, and technology solutions make it impossible for the City to chart progress or control costs related to unnecessary idling. Therefore, Clean Fuels Ohio recommends the City create new procedures to track and eliminate unnecessary idling through tracking, training, and technology solutions.

Key Recommended Action: *Track and Eliminate Unnecessary Vehicle Idling*

5. ***Create new procedures to track and eliminate unnecessary vehicle idling including:***
    a. ***Creation of a clear tracking methods:***
    b. ***Development of Idle-Reduction Training for Operators***
    c. ***Deployment of Cost Effective Technologies:*** *such as GPS tracking systems, engine timers, auxiliary power systems, and automatic engine shutdown devices.*

Equipment Longevity & Driver Performance —Training, Tracking & Incentives:

A fleet's business is in its driver's hands. Fleet vehicles, public safety, and the city's bottom line are at stake. In fact, as much as 90% of accidents and up to 33% of fleet fuel use is impacted by vehicle driver and equipment operator behavior. Skills and safety training are obvious requirements for operators of heavy-duty municipal fleet equipment. However, additional fuel-efficiency and vehicle longevity and maintenance trainings can improve the performance of even highly experienced drivers and equipment operators.

The City of Cincinnati currently trains its drivers on the basic tenets of fuel-efficient driving such as the basics outlined in the table below. However, studies have shown that initial fuel savings achieved through driver training can diminish over time once training ends. This is where tracking, performance reviews, and incentives come in. Several strategies are available to maintain fuel-efficient driving techniques and ensure proper maintenance and equipment longevity practices are followed once training is over.

Fuel Efficient Driving Basics:	Longevity & Maintenance Basics
• Progressive shift: Start in a gear that doesn't require using the throttle when releasing the clutch and Shift up at very low rpm.	• Utilizing synthetic lubricants and observing proper oil replacement intervals.
• Block shift where possible. (For example, shift from third to fifth gear.)	• Observing recommended preventative maintenance schedules.
• Maintain a steady speed while driving:	• Deploying fuel efficient tires.
• Use cruise control where appropriate.	• Using aerodynamic solutions.
• Anticipate traffic flow; coast where possible.	• Removing excess vehicle weight.
• Brake and accelerate smoothly and gradually.	• Maintaining proper tire inflation.

Vehicle instrumentation, such as on-board computers that report fuel consumption, is available and can help maintain driver awareness and fuel efficient performance. Vehicle tracking systems that record fuel consumption, speed and other key indicators of driving style and vehicle performance are also available. Such technologies also provide data to fleet managers via mobile communication systems in real time. This information can feed into performance reviews and reward programs for drivers who continue to practice fuel-efficient and safe driving techniques, and perhaps provide reminders for those that do not.

Recognition for a job well done does not need to be elaborate or expensive. For example, fleets have personalized posters and rewards by featuring photos of actual fleet drivers. Other fleets have performed regular spot checks and awarded small gift certificates to operators practicing proper efficiency and safety practices. These incentives are doable even within the confines of potential union and city regulations about providing incentives. Some municipalities have even participated in friendly departmental or inter-divisional competitions. These competitions have generally been based on overall reductions in fuel consumption, or more specific parameters such as idle reduction. These fleet challenges provide a fun way to engage drivers and demonstrate potential impacts of behavior changes.

Based on data gathered by the Canadian SmartDriver program, which has worked with 40 fleets representing 10,000 trucks, fuel efficiency training can reduce fuel consumption by five to 10 percent. The US EPA's equivalent training program, Smartway, reports average fuel savings of about five percent. Similarly, EcoDriving studies in Europe have recorded fuel efficiency gains in the five to 10 per cent range.[4] Fuel consumption varies greatly between fleets and even among vehicle types within a single fleet. However, if a heavy-duty diesel vehicle in your municipal fleet typically consumes 10,000 gallons of fuel per year, such driver training could offer the potential to save between 500 and 1,000 gallons (five to 10 per cent) of fuel per year. Such reductions have the potential to amount to $1,500 - $3,000 annually per vehicle savings (based on $3.00 gallon diesel). Similar savings can also be realized in light duty vehicle classes and operations.

There are numerous fuel-efficient driver training and safety programs available that can be tailored to fit the needs of any fleet. Clean Fuels Ohio recommends that the City of Cincinnati adopt a threefold

[4] Natural Resources Canada, 2010. Federation of Canadian Municipalities, *Enviro Fleets: Reducing Heavy Duty Vehicle Emissions, A Guide to Best Practices*, November 2010, pp. 20-21.

strategy for driver performance that includes training, tracking, and incentives. Industry best practices reveal that such multi-strategy approaches yield the best results and are sustainable over the long term.

Key Recommended Action: *Improve Equipment Longevity & Driver Performance*
6. ***Improve equipment longevity and driver safety and fuel efficiency performance by:***
a. ***Adopting more robust training:*** develop parameters of needs and issue and competitive RFP for relevant driver efficiency and maintenance best practice training programs.
b. ***Development driver tracking and review procedures:*** track relevant safety, idling, and efficiency data on a driver basis and establish mechanisms to review with
c. ***Create Cost-Effective Incentive Systems:*** *reward best practices through incentives ranging from regular recognition to monetary rewards*

Alternatives to Ownership—Leasing, Car-sharing, & Other Fleet Models:

The decision to rent, lease, or purchase vehicles and equipment is a complex matter; but understanding the details can translate to real world differences in fleet age and the ultimate costs or savings realized.

Case Study: Leasing vs. Ownership Advantages	
Leasing Advantages:	**Ownership Advantages:**
1. Preservation of Capital. The capital you need to run your operations comes from one of two sources: revenue or a lender. Leasing provides a third source. It enables an entity to obtain vehicles without using precious operating capital or dipping into credit lines.	***1. Incentive Benefits***. Owners can take advantage of all tax benefits and vehicle incentives, whether currently or in the future (as carry-forwards).
2. Off-Balance Sheet Treatment. Vehicle ownership can also unnecessarily burden your balance sheet. Buying vehicles requires two entries on the balance sheet. Although the asset side gets the vehicle, the liabilities side gets debt or a reduction in capital. A properly structured lease permits off-balance-sheet treatment.	***2. Pricing Leverage.*** Using local dealerships for all acquisitions, with the attendant promise of future service business and employee referrals, can be leveraged in negotiating attractive pricing. Using a large national fleet dealer group can provide "big fleet" pricing to small and midsized fleets.
3. Lessor Acquisition/Disposal. The actual processes of vehicle acquisition and disposal are time consuming and require some expertise to do well. Independent lessors can lease any make or model, order the vehicle for you, pay for it, and obtain the title and tags, relieving you and your employees these tasks. Lessors are also better equipped to sell vehicles when they come out of service.	***3. Net Present Value Cost***. In some instances, the net present value cost of ownership can be lower. Lessors make money in a number of ways: through purchasing vehicles, by charging administrative fees, or marking up the cost of funds. A company can avoid these costs by purchasing vehicles, provided pricing is aggressively negotiated. Money is available at an attractive rate and, most importantly, resale proceeds are maximized.
4. Less Administration. Vehicle ownership carries with it various administrative burdens, such as tag and license renewal, title retention, etc. A leased vehicle is owned by the lessor, whose name is on the title and the registration. The administration of all such requirements of ownership falls to the lessor.	***4. Depreciation Control.*** The single largest cost in running a fleet is vehicle depreciation. Fleets give up some measure of control of this number to a lessor, who will resell vehicles in bulk. The ability (or desire) to sell vehicles individually will, if done properly, inevitably lower net depreciation costs.
5. Use vs. Ownership. Finally, the practical question must be asked: Do I need to own vehicles or do I need to use them? Vehicles are most often either a business tool, that is, a means by which the business accomplishes its goals, or a form of compensation.	**Source:** Automotive Fleet, January 2007, *Navigating the Lease Vs. Own Maze*. Web, November 2011: <http://www.fleetsolutions.com/uploads/AF1_18-21.pdf>

As the case study above demonstrates, there are many factors to take into account before these decisions can be made. For instance, understanding fleet vehicle utilization will be important to determining whether lease or rental options are relevant and workable within fleet operations and life-cycles. If such options are feasible, it's important to identify whether the relevant fleet assets are available to be leased or rented locally? And of course, determining the average capital and operating cost over a given time and comparing with total costs of ownership will be essential.

While many of these factors can be determined internally, it is also necessary to seek competitive proposals to identify the most attractive terms and rates available. With this in mind, Clean Fuels Ohio recommends that the City of Cincinnati apply standard models and pay-back calculations to determine the feasibility of other vehicle and equipment options besides traditional ownership models, including leasing, car-sharing, vehicle rental, and expanded use of personal vehicle reimbursements.

Key Recommended Action: *Examine Cost Savings from Alternatives to Ownership*

7. ***Apply standard models and pay-back calculations to determine the feasibility of other vehicle and equipment options beside traditional ownership models:***
    a. *Explore Leasing, Car-Sharing, Vehicle Rental, and Personal vehicle reimbursements.*
    b. *Issue competitive request for proposals around each option to determine the real world cost effectiveness of deploying each option in city operations.*

Fuel Options Analysis – Exploring Conventional and Alternative Sources:

Conventional Fuel Baselines and Projections:

While Clean Fuels Ohio's supports increased use of cleaner, domestic fuel options, it is unlikely that the City will find it cost effective to completely eliminate all gasoline and diesel fuels from its operations by 2025. The City has several advantages when purchasing fuel, including exemptions from fuel taxes and the ability to negotiate attractive pricing based on the large fuel volumes it purchases. However, CFO believes there are significant benefits to transitioning a substantial portion of the City's fuel use to cleaner, domestic fuel alternatives while continuing to use gasoline and diesel in some applications.

The conventional petroleum fuel market remains relatively tight, with high price volatility for the foreseeable future stemming from increasing global demand, decreasing global reserves, and potential supply and refining interruptions stemming from natural disasters, wars, and economic downturns (to name only a few potential factors). The U.S. Energy Information Administration (EIA) collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy's interaction with the economy and environment. The table below summarizes the most recent EIA petroleum fuel price projections extending to 2025. While any projections this far into the future remain relatively speculative, the EIA projections draw on well respected data sources from across world energy industry, market, and government analysts.

Conventional Fuels: 15 Year Price Projections[5]				
	Gasoline Gallon (2011 dollars)		Diesel Gallon (2011 Dollars)	
Year	Median Reference	High Reference	Median Reference	High Reference
2011	$3.09	$3.80	$3.31	$4.01
2012	$3.18	$4.21	$3.39	$4.42
2013	$3.27	$4.44	$3.48	$4.65
2014	$3.34	$4.59	$3.56	$4.80
2015	$3.43	$4.73	$3.64	$4.94
2016	$3.50	$4.85	$3.71	$5.06
2017	$3.58	$4.98	$3.79	$5.19
2018	$3.65	$5.10	$3.86	$5.31
2019	$3.71	$5.20	$3.92	$5.41
2020	$3.77	$5.31	$3.98	$5.52
2021	$3.83	$5.40	$4.04	$5.61
2022	$3.87	$5.49	$4.08	$5.70
2023	$3.92	$5.57	$4.14	$5.78
2024	$3.97	$5.65	$4.18	$5.87
2025	$4.01	$5.72	$4.22	$5.93

Based on the best price projections available and the inherent volatility in the petroleum fuel markets, Clean Fuels Ohio recommends the City explore fuel hedging options in detail during Phase II of its strategic green fleet planning process. In addition to exploring hedging options, Clean Fuels Ohio recommends the City use life-cycle costs analysis to select the most energy-efficient conventional vehicle models when acquiring new gasoline or diesel powered units.

Key Recommended Action: *Acquire the most fuel-efficient conventional vehicles*

8. ***Acquire energy efficient and alternative fuel vehicles whenever the lifecycle costs (including all available subsidies) are less than the lifecycle cost of conventional vehicles.***
   a. *Explore fuel hedging options in Phase II of the planning process to guard against price volatility.*
   b. *Use life-cycle costs analysis to select the most energy-efficient, new conventional vehicles.*

Alternative Fuel Options—Explanations, Projections, and Recommendations

Biodiesel:

Biodiesel fuel is made from domestic, renewable, non-petroleum sources, and is cleaner burning as demonstrated in the chart below. The levels of emissions reductions will depend on the specific feedstock and method of biodiesel production. Cutting edge technologies continue to improve the performance of the most advanced bio-fuels. Biodiesel is commonly mixed with conventional petroleum

[5] United States. Energy Information Administration. *Figure 13. Average Annual World Oil Prices in Three Cases, 1980-2035 (2009 Dollars per Barrel).* 26 Apr. 2011. Web. 15 Nov. 2011. (Adjusted to 2011 dollars using based on the latest US government Consumer Price Index data released on November 16, 2011).

diesel fuel to produce blends with varying ratios of biodiesel to petroleum (e.g. B20 indicates a blend with 20% biodiesel and 80% petroleum diesel). Blended biodiesel has been proven to perform well. Its added lubricity decreases engine wear, and increased solvency can reduce build up of deposits. In its most common blend, B20, biodiesel contains approximately the same energy of a diesel equivalent gallon making vehicle power and performance immediately comparable to conventional fuels.

Biodiesel Emission Reductions from Typical Diesel Baseline Emissions [6,7]					
	PM	**NO_2**	**CO**	**HC**	**CO_2**
B20, pre-2007 engine	10 %	0 %	11%	21%	11%
B100, pre-2007 engine	50 %	0%	50 %	68 %	57%

For the past several years blended biodiesel fuels have run at a small incremental premium to conventional diesel fuel. The table below details the average B20 price from 37 Midwestern fuel retailers over the third quarter 2011. As the table shows, B20 currently retails for approximately $0.01 more than conventional diesel fuel.

	Biodiesel (B20) Information Reported by Clean Cities ($ per gal)		*Diesel Information Reported by Clean Cities ($ per gal)*	
	Average Price/ Standard Deviation of Price	*Approximate Number of Stations*	*Average Price/ Standard Deviation of Price*	*Approximate Number of Stations*
Midwest	$3.73 / 0.20	37	$3.72 / 0.15	112
NATIONAL AVERAGE	$3.91 / 0.34	148	$3.81 / 0.23	363

While 2011 B20 prices have remained highly competitive with conventional diesel fuels, the market is currently backed by a $1 per gallon blender's tax credit which is set to expire on December 31, 2011. With current federal budgets increasingly geared toward cost cutting measures, it is likely that the tax credit will not be extended in the near-term. While the price of biodiesel is not expected to increase by a full dollar once the credit expires, it is likely that the current price differential will significantly increase.

While any diesel vehicle is capable of running biodiesel blends without alternation, several preparatory requirements must be kept in mind when first transitioning to biodiesel fuels. First, biodiesel has significant solvent properties, leading the use of biodiesel blends to clean any debris or deposits from storage tanks, fuel tanks, and engine systems. The recommended best practice for transitioning to biodiesel fuel involves cleaning any tank that has previously stored conventional diesel. In addition, when first transitioning to biodiesel blends fleets may experience an initial increase in vehicle filter

[6] United States. Department of Energy. Energy Efficiency and Renewable Energy. Alternative Fuels and Advanced Vehicles Data Center: Biodiesel Emissions. 10 July 2009. 1 Apr. 2010 <http://www.afdc.energy.gov/afdc/vehicles/emissions_biodiesel.html>.

[7] United States. Environmental Protection Agency. Office of Transportation and Air Quality. Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis. Feb. 2010. 1 Apr. 2010 <http://www.epa.gov/otaq/renewablefuels/420r10006.pdf>.; GHG reduction estimate is based on typical soybean biodiesel plant and includes the mid-point estimated effect from land-use change. Greater emission reduction is possible if the effect of land use change is less than estimated.

changing intervals due to the solvent and system cleansing properties of biodiesel. The lower the blend of biodiesel used, however, the lower the probability of these experiences, since much of the solvent properties of the fuel will be diluted by the higher percentage of conventional diesel fuel in the blend.

Based on this expected price increase, Clean Fuels Ohio recommends that the City not explore biodiesel use in the immediate near-term if cost-effectiveness is the main consideration. However, even lower biodiesel blends offer substantial benefits over conventional diesel fuel when factoring in full social benefits including emissions, sustainability, and energy security. Clean Fuels Ohio has helped many fleets effectively transition to biodiesel fuel, including schools and municipalities, and we recommend the City of Cincinnati continue to explore biodiesel fuel for its operations, especially in low blends.

Recommendation: Wait to Use Biodiesel Until its Cost Effective for City Operations

- ***Based on expected biodiesel price increases, Clean Fuels Ohio recommends that the City not explore biodiesel use in the immediate near-term if cost-effectiveness is the main consideration.***
  - *During Phase II, develop biodiesel decision matrix to determine best point to use biodiesel, balancing fuel cost parameters with other benefits of using biodiesel fuel.*

Ethanol—E85:

Ethanol is a renewable fuel made from various plant based materials, which are collectively called "biomass." Ethanol contains the same chemical compound (C_2H_5OH) found in alcoholic beverages. Ethanol is well suited to internal combustion engines and is a high-octane fuel. Beyond its renewability, ethanol is a largely domestic transportation fuel. Whether used in low-level blends, such as E10 (10% ethanol, 90% gasoline), or in E85 (85% ethanol, 15% gasoline), ethanol helps reduce imported oil and greenhouse gas emissions. Its use also supports the U.S. agricultural industry.

Low-level ethanol blends such as E10 already constitute nearly half of the gasoline sold in the United States and the majority sold in Ohio. Low-level blends require no special fueling equipment and can be used in any gasoline-powered vehicle. E85 fueling equipment is slightly different than petroleum fueling equipment, but the costs are similar. In most cases, it is possible to convert existing petroleum equipment to handle E85. Flex Fuel Vehicles (FFVs) designed to run on E85 are becoming more common each model year, and FFVs are typically available as standard equipment with little or no incremental cost. Also, because FFVs can be fueled with gasoline as well as E85, drivers have the flexibility to travel outside of areas served by E85 fueling stations.

The City currently owns 338 Flex Fuel vehicles including sedans, vans, and pickup trucks. The City also operates four ethanol capable fueling facilities, each with 10,000 gallons in capacity. While ethanol can easily be adopted into the City's operations, cost effectiveness is a major consideration. Ethanol fuel has less energy per volumetric unit than gasoline. A gallon of pure ethanol (E100) contains 34% less energy than a gallon of gasoline. E85 has between 20%-27% less energy per gallon than gasoline (mileage penalty lessens as ethanol content decreases). E85 is typically priced lower than gasoline, so that cost per mile is comparable. However, as the table below demonstrates, use of E85 at current retail

prices ($3.12/E85 gal. vs. $3.38/gas gal.) will result in incrementally higher operational and life-cycle costs for city vehicles. What is more, the City currently purchases gasoline ($3.03/gal) for less than it is able to purchase E85 ($3.05/gal) because of volume discounts. The table below shows current annual fuel and operating cost projections for use of ethanol in the four vehicle models that compose the majority of E85 vehicles in the City's flex fuel fleet.

Vehicle	Annual Fuel Use	Annual Electricity Use	Annual Fuel/Elec Cost	Annual Operating Cost	Cost Per Mile	Annual Emissions (lbs CO2)
2010 Dodge Avenger Gasoline	577 gal	0 kWh	$1,949	$4,207	$0.35	13,840
2010 Dodge Avenger FFV	663 gal	0 kWh	$2,103	$4,361	$0.37	10,767
2005 Ford Taurus Gasoline	559 gal	0 kWh	$1,891	$4,149	$0.35	13,428
2005 Ford Taurus FFV	712 gal	0 kWh	$2,259	$4,516	$0.38	11,564
2005 Dodge Stratus 4 Door FFV	681 gal	0 kWh	$2,161	$4,419	$0.37	11,065
2005 Dodge Stratus Gasoline	559 gal	0 kWh	$1,891	$4,149	$0.35	13,428
2009 Dodge Caravan/Grand Caravan FWD FFV	811 gal	0 kWh	$2,572	$4,830	$0.40	13,169
2009 Dodge Caravan/Grand Caravan FWD Gasoline	619 gal	0 kWh	$2,093	$4,351	$0.36	14,864

Based on current price and energy differentials, Clean Fuels Ohio recommends that the City not use Ethanol (E85) in the immediate near-term if cost-effectiveness is the main consideration. Given that E85 has 20%-27% less energy per gallon, the city should begin to use E85 when the price per gallon is 20% or more below the current cost of gasoline for city operations.

Recommendation: Wait to Use Ethanol Until its Cost Effective for City Operations

- ***Based on current price differentials, Clean Fuels Ohio recommends that the City not use Ethanol (E85) in the immediate near-term if cost-effectiveness is the main consideration.***
  - *During Phase II, develop a decision matrix to determine best point to use ethanol fuel. Since E85 has 20%-27% less energy per gallon, the city should begin to use E85 when the price per gallon is 20% or more below the current cost of gasoline for city operations.*

Propane Autogas (LPG):

Propane, also known as liquefied petroleum gas (LPG or LP-gas), or autogas in Europe, is a three-carbon alkane gas (C_3H_8). Stored under pressure inside a tank, propane turns into a colorless, odorless liquid. As pressure is released, the liquid propane vaporizes and turns into gas that is used for combustion. An odorant, ethyl mercaptan, is added for leak detection. Propane has a high octane rating and excellent properties for spark-ignited internal combustion engines. It is non-toxic and presents no threat to soil, surface water, or groundwater.

Propane is produced as a by-product of natural gas processing and crude oil refining. It accounts for about 2% of the energy used in the United States. The interest in propane as an alternative transportation fuel stems mainly from its domestic availability, high energy density, and clean-burning

qualities. It is the world's third most common engine fuel. Propane is considered an alternative fuel under the Energy Policy Act of 1992. Because propane is transformed into a gaseous state before it is burned in an internal combustion engine, the engine runs more efficiently in low-speed, light-throttle conditions. The introduction of Liquid Propane Injection engine systems also promises higher fuel efficiency for propane vehicles. Propane also offers significant emissions benefits as detailed below.

Reduction from Propane Fuels based on typical diesel baseline emissions*					
	PM	**NO_x**	**CO**	**HC**	**CO_2E/ GHG**
Propane (new heavy-duty vehicle)	100%	> 60%	>90	>80%	19%
Propane (conversion)	80%	0%	20-40%	- 10%	21-24%

**Based on rigorous government-funded studies of current technology mix and typical usage patterns. See details for propane[8,9,10]. These figures, and new studies on which the figures are based, are posted at the U.S. Department of Energy's Alternative Fuels Data Center at http://www.afdc.energy.gov/afdc.*

The City of Cincinnati acquired propane fueled vehicles as a sub-recipient in Clean Fuels Ohio's US Dept. of Energy Clean Cities grant award in 2009. The City currently operates 25 propane powered vehicles and 21 pieces of propane powered equipment including multiple forklifts. The City also operates two propane refueling stations at its facilities, each with 1,000 gallon capacity. The current propane vehicles deployed by the City were acquired at no additional cost over conventional models as a result of grant funding. The associated fuel stations also required no additional investment since the City was able to amortize the infrastructure costs into its current (still highly competitive $2.29/gal) propane fuel price.

The propane fueled vehicles currently deployed by the City are already offering relatively significant savings on annual fuel purchases. With the incremental cost of light-medium duty propane vehicles ranging from $7,000-$12,000, both current and future propane vehicles deployed in City operations will easily result in a net lifetime savings if fuel usage meets basic minimum thresholds. Since the City already operates two propane fueling stations, the fleet will not have to make any significant infrastructure investments to expand the use of propane powered vehicles. In fact, increasing the City's use of propane vehicles is likely to increase fuel volume and allow the City to negotiate an even more favorable price on propane fuel from its suppliers. In this scenario, the overall lifetime cost savings for propane vehicles can be substantial. If additional stations are required, the total capital costs for a propane station is relatively low ($15,000-$20,000), and these costs can continue to be amortize while maintaining low fuel costs. The table below demonstrates the lifetime cost savings for three propane vehicle models compared to conventional fuels, using real-world price data from Cincinnati's operations.

[8] Department of Energy. Argonne National Laboratory. *A Full Fuel-Cycle Analysis of Energy and Emissions Impacts of Transportation Fuels Produced from Natural Gas*. By M. Q. Wang and H. S. Huang. Dec. 1999. Web. 1 Apr. 2010. <http://www.ipd.anl.gov/anlpubs/2000/01/34988.pdf>.

[9] United Kingdom. Department of Trade and Industry. *The Report of the Alternative Fuels Group of the Cleaner Vehicles Task Force*. Jan. 2000. Web. 1 Apr. 2010. <http://www.cleanairnet.org/infopool/1411/articles-35613_assessment_emission.pdf>.

[10] Antes, Matt, Ross Brindle, Joe McGervey, Lindsay Pack, and Beth Zotter. Propane Reduces Green House Gas Emissions: A Comparative Analysis. June 2007. Propane Education and Research Council. 1 Apr. 2010 <http://www.propanecouncil.org/uploadedFiles/Propane_Reduces_GHG_Emissions_%282007%29.pdf>.

Select Propane Vehicle Lifetime Savings vs. Conventional Models						
Capital Costs	**F250 (gas)**	**F250 (LPG)**	**F350 (diesel)**	**F350 (LPG)**	**E250 (gas)**	**E250 (LPG)**
Base Vehicle Price	$28,755	$40,160	$31,764	$43,169	$21,047	$31,447
Incremental Cost		$11,405		$11,405		$10,400
Operating Costs (fuel)						
Total Vehicle Life (miles)*	150,000	150,000	150,000	150,000	150,000	150,000
Average Miles Per Gallon	13	11.7	13	11.7	13	11.7
Gallons of Fuel Used (lifetime)	11,538.46	12,820.5	11,538.46	12,820.5	11,538.46	12,820.5
Fuel Price**	$3.82	$2.05	$3.88	$2.05	$3.82	$2.05
Lifetime Fuel Costs	$44,076.92	$26,282.03	$44,769.22	$26,282.03	$44,076.92	$26,282.03
Total Savings or Costs		**$17,794.89**		**$18,487.20**		**$17,794.89**
Operating Costs (misc.)						
Maintenance Rate/Mile***	$0.03	$0.015	$0.03	$0.015	$0.03	$0.015
Maintenance Costs	$4,500	$2,250	$4,500	$2,250	$4,500	$2,250
Total Savings or Costs		**$2,250**		**$2,250**		**$2,250**
Lifetime Savings						
Gross Savings		**$20,044.89**		**$20,737.20**		**$20,044.89**
Net Savings		**$8,639.89**		**$9,332.20**		**$9,644.89**

**Assuming addition vehicle life based on reduced wear and maintenance from use of cleaner burning propane fuel.*
***Assuming the City negotiates a slightly more favorable fuel rate with suppliers. Does not factor in current $0.50/gallon tax credit set to expire December 31, 2011.*
****A 50% reduction in maintenance costs by running a vehicle on propane, compared to gasoline. A factor the Texas Railroad Commission uses in their calculations when considering an alternative fuel conversion.*

Based on the potential net lifetime savings and the significant emission reductions offered by propane powered vehicles, Clean Fuels Ohio recommends the City acquire more propane powered equipment for its operations. Not only are light and medium duty vehicles available, but the City should also begin to explore adopting propane powered lawn and maintenance equipment. Such equipment has relatively similar incremental price differences, lifetime savings, and environmental benefits. When factoring in the potential of subsidies such as grants or tax credits, the overall lifetime savings from propane projects becomes even more significant, making propane powered equipment a cost effective choice for the City.

Key Recommended Action: *Expand Use of Propane Vehicles and Equipment*

8. ***Acquire energy efficient and alternative fuel vehicles whenever the lifecycle costs (including all available subsidies) are less than the lifecycle cost of conventional vehicles.***
   c. *Expand use of propane vehicles for light and medium duty applications whenever feasible.*
   d. *Replace lawn and maintenance equipment with propane options whenever feasible.*

Compressed Natural Gas (CNG):

Natural gas has a high octane rating and excellent properties for spark-ignited internal combustion engines. Natural gas is a mixture of hydrocarbons, predominantly methane (CH_4). It is non-toxic, non-corrosive, and non-carcinogenic. It presents no threat to soil, surface water, or groundwater. Most natural gas is extracted from gas and oil wells. Much smaller amounts are derived from supplemental sources such as synthetic gas, landfill gas and other biogas resources, and coal-derived gas. Natural gas accounts for approximately one quarter of the energy used in the United States. Of this, about one third goes to residential and commercial uses, one third to industrial uses, and one third to electric power production. Only about one tenth of one percent is currently used for transportation fuel. Since the City of Cincinnati currently has no CNG vehicles or fueling infrastructure in its fleet operations, it is important to thoroughly examine available vehicles, fuel prices and supply, and infrastructure options. A brief overview of each of these categories follows:

Vehicles—Natural gas vehicles are available in nearly all class sizes and applications. Some of these vehicles can be ordered directly from the original manufacturer, others must be up-fitted or converted by a third party. Dedicated natural gas vehicles (NGVs) are designed to run only on natural gas, while bi-fuel NGVs have two separate fueling systems that enable the vehicle to use either natural gas or a conventional fuel (gasoline or diesel). In general, dedicated NGVs demonstrate better performance and have lower emissions than bi-fuel vehicles because their engines are optimized to run on natural gas. In addition, the vehicle does not have to carry two types of fuel, thereby increasing cargo capacity and reducing weight. Supplementary information has been supplied with this report detailing all currently available, EPA certified natural gas vehicles, engine systems, and conversion kits (See attached document titled, "Available NGVs").

Natural gas vehicles are fueled with compressed natural gas (CNG) or liquefied natural gas (LNG). These fuels are considered alternative fuels under the Energy Policy Act of 1992 and qualify for alternative fuel vehicle tax credits. The driving range of NGVs generally is less than that of comparable gasoline- and diesel-fueled vehicles because of the lower energy content of natural gas. Extra storage tanks can increase range, but the additional weight may displace payload capacity. NGV horsepower, acceleration, and cruise speed are comparable with those of an equivalent conventionally fueled vehicle. In addition, some natural gas vehicle owners report service lives two to three years longer than gasoline or diesel vehicles and extended time between required maintenance. Compared with conventional vehicles, NGVs produce significantly lower amounts of harmful emissions as detailed in the table below.

CNG Emission Reductions from Typical Diesel Baseline Emissions*					
	PM	**NO_x**	**CO**	**HC**	**CO_2E/ GHG**
CNG	95%	49%	75%	4%	21-26%
LNG	86-100%	17-80%	0%	59-100%	21-25%
**Based on rigorous government-funded studies of current technology mix and typical usage patterns. See details for natural gas [11], These figures, and new studies on which the figures are based, are posted at the U.S. Department of Energy's Alternative Fuels Data Center at http://www.afdc.energy.gov/afdc.*					

[11] United States. Department of Energy. Argonne National Laboratory. *A Full Fuel-Cycle Analysis of Energy and Emissions Impacts of Transportation Fuels Produced from Natural Gas*. By M. Q. Wang and H. S. Huang. Dec. 1999.

In addition to emissions benefits, natural gas vehicles offer potential lifetime costs savings, largely stemming from lower fuel and maintenance costs, as detailed in the table below.

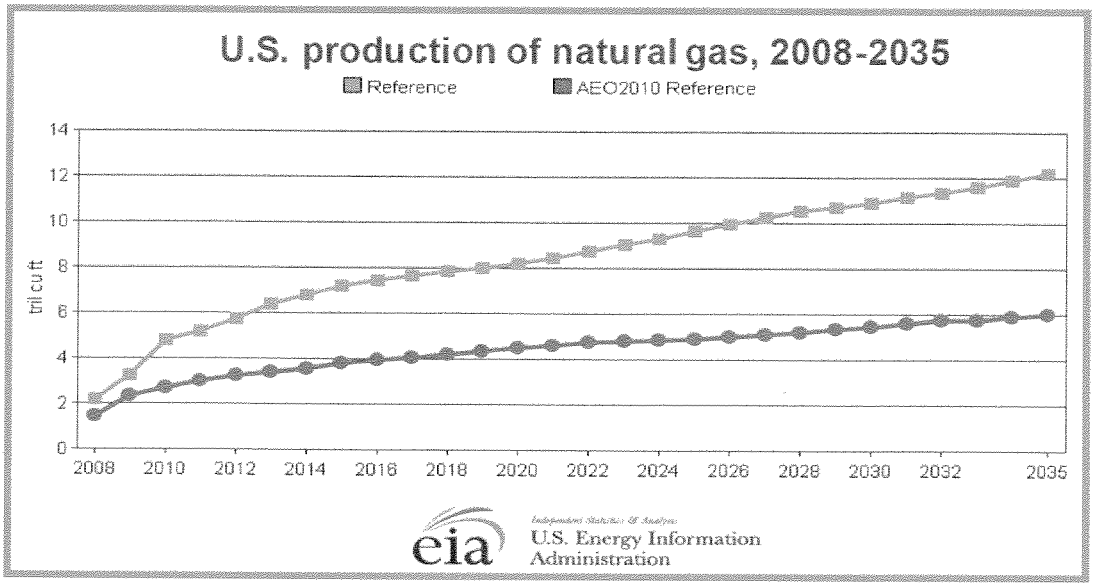
Select CNG Vehicle Lifetime Savings vs. Conventional Diesel Models						
Capital Costs	**Tandem Axel Dump (diesel)**	**Tandem Axel Dump (CNG)**	**Refuse Auto Side Loader (diesel)**	**Refuse Auto Side Loader (CNG)**	**Front Loader (diesel)**	**Front Loader (CNG)**
Base Vehicle Price	$180,057	$211,334	$256,129	$291,129	$222,721	$262,997
Incremental Cost		$31,277		$35,000		$40,276
Operating Costs (fuel)						
Total Vehicle Life (miles)	150,000	150,000	150,000	150,000	150,000	150,000
Average Miles/Gallon	3.84	3.84	3	3	2.8	2.8
Gallons of Fuel Used (lifetime)	39,062.5	39,062.5	53,571.42	53,571.42	68,807.33	68,807.33
Fuel Price (CNG DGE)	$3.80	$1.94	$3.80	$1.94	$3.80	$1.94
Lifetime Fuel Costs	$148,437.5	$75,781.25	$203,571.39	$103,928.55	$261,467.85	$133,486.22
Total Savings or Costs		**$72,656.25**		**$99,642.84**		**$127,981.63**
Operating Costs (misc.)						
Maintenance $/Mile*	$0.03	$0.015	$0.03	$0.015	$0.03	$0.015
Maintenance Costs	$4,500	$2,250	$4,500	$2,250	$4,500	$2,250
Total Savings or Costs		**$2,250**		**$2,250**		**$2,250**
Lifetime Savings						
Gross Savings		**$75,156.25**		**$102,142.84**		**$130,481.63**
Net Savings		**$43,879.25**		**$67,142.84**		**$90,205.63**

***A 50% reduction in maintenance costs by running a vehicle on CNG, compared to gasoline. A factor the Texas Railroad Commission uses in their calculations when considering an alternative fuel conversion.*

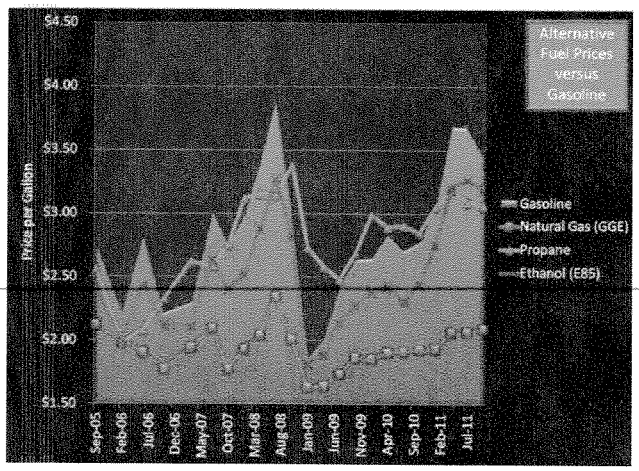
Fuel Supply & Price—Currently, the United States is experiencing a boom in natural gas supply and production. Over 40 states have natural gas resources in 22 shale basins spread throughout the country. New recovery methods such as hydraulic fracturing have significantly improved the outlook for recoverable reserves. In fact, reserves and production forecasts have doubled in recent years. New reserve-to-production ratios have climbed to estimates of greater than 100 years domestic supply. Shale gas is offsetting declines in conventional gas production and is the driving factor of the recent boom in natural gas supply. It is important to note that the majority of this supply will come from both conventional sources and new hydraulic fracturing methods. While hydraulic fracturing remains a contentious subject in environmental circles, natural gas also has the potential to be generated from renewable sources such as captured methane from landfills and bio-methane created by anaerobic

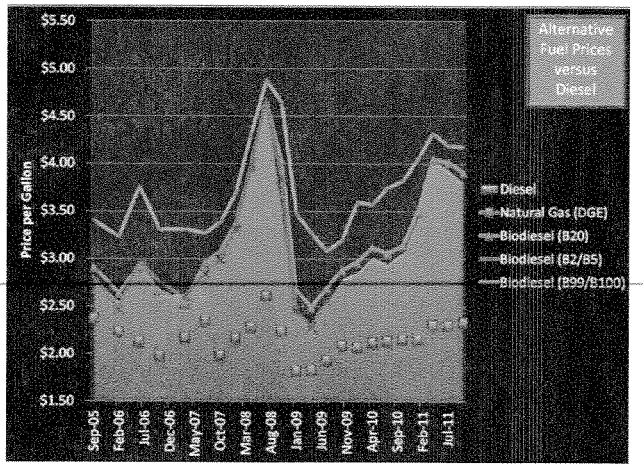
Web. 1 Apr. 2010. <http://www.ipd.anl.gov/anlpubs/2000/01/34988.pdf>. Specific reductions depend on vehicle type, model year, and use patterns.

digestion of organic waste streams. The graph below details the Energy Information Administration's current long term natural gas supply projections.



CNG has a lower price than diesel for all regions of the country, with the largest difference ($2.19 per Diesel Gallon Equivalent) in the Rocky Mountain region. On average, CNG costs $1.48 less than diesel on a per diesel gallon equivalent basis. Over the third quarter of 2011, average price from a diesel equivalent gallon of CNG was $1.94 in the Midwest, compared to $3.72 for diesel fuel. The following graphs detail the stability of CNG prices relative to gas and diesel over the past five years. With large new domestic supplies coming to market, CNG prices are expected to remain low and stable.

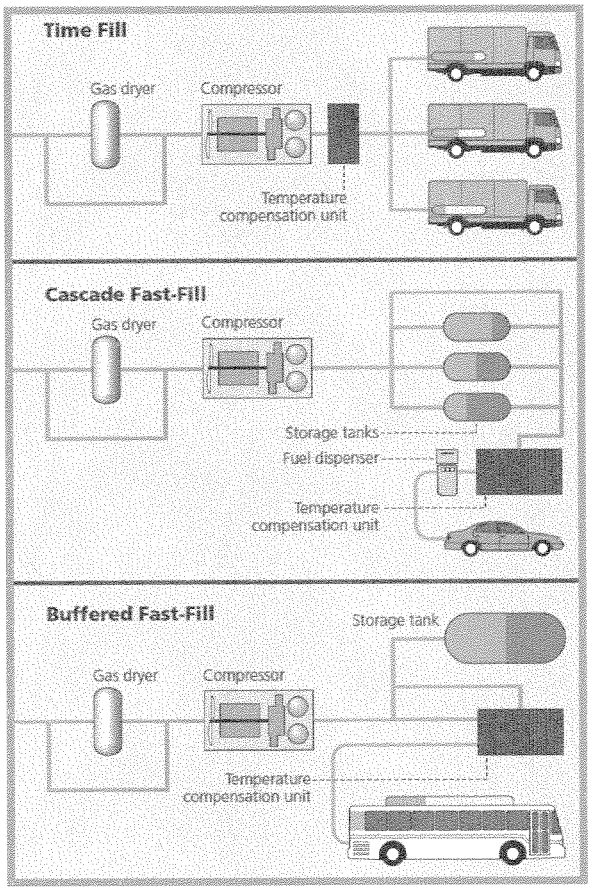




Stations—The United States has a vast natural gas distribution system that can quickly and economically distribute natural gas to and from almost any location in the lower 48 states. Gas is distributed between and within states by 300,000 miles of transmission pipelines. Beyond these, an additional 1.9 million miles of distribution pipes transport gas within utility service areas. The distribution system also includes

thousands of delivery, receipt, and interconnection points; hundreds of storage facilities; and more than 50 points for exporting and importing natural gas.

Most natural gas fueling stations dispense compressed natural gas (CNG), which is either compressed on site or compressed off site and transported to the station in tanks. Selecting the right configuration is key to any CNG station's success. Some of the most important issues to consider in choosing a station type are the number and type of vehicles fueled and their fueling pattern. Secondary considerations include location, potential future growth, and permitting restrictions. The picture to the right illustrates three broad categories of CNG station types: Time Fill (or slow fill) Stations, Cascade Fast Fill Stations, and Buffered Fast-Fill Stations.



Station construction and operation costs vary widely depending on the fuel volume needed, storage capacity, flow and pressure rates, and the total number of vehicles that need fueled in a given 24 hour period. Competitive size and price options are available and gas supply companies will often discount overall station prices if minimum gas volumes can be guaranteed. Clean Fuels Ohio has worked to develop numerous CNG station projects with municipalities, schools and private business throughout the state, helping to assess full project costs including any necessary building modifications, volume based purchasing agreements, and station ownership and amortization models.

Based on the long term fuel price differentials and stable supply, as well as economic and environmental benefits, Clean Fuels Ohio recommends the City explore full CNG vehicle and station projects costs during the second phase of its strategic green fleet planning process.

Key Recommended Action: *Conduct Study of CNG Vehicle and Station Costs*

8. ***Acquire energy efficient and alternative fuel vehicles whenever the lifecycle costs (including all available subsidies) are less than the lifecycle cost of conventional vehicles.***
   e. *Conduct detailed study of the total costs of CNG vehicle and station project costs and savings during Phase II of the green fleet strategic plan development process.*

Hybrid Electric Vehicles:

Hybrid electric vehicles (HEVs) are powered by an internal combustion engine or other propulsion source that can be run on conventional or alternative fuel and an electric motor that uses energy stored in a battery. HEVs combine the benefits of high fuel economy and low emissions with the power and range of conventional vehicles. A variety of hybrid electric vehicles are currently available. The key to the most cost-effective introduction of hybrid vehicles into any fleet lies in identifying the particular applications and duty cycles that will maximize hybrid system efficiencies such as regenerative braking and low speed electric launch assist. Urban duty cycles with routine stop and go traffic patterns are often the sweet spot for hybrid vehicle applications.

The table below illustrates the most common hybrid vehicles currently deployed in the City fleet as well as relevant alternatives. As the table shows, hybrid vehicles offer savings on annual fuel and operating costs and result in lower emissions. However, for the majority of hybrid vehicles currently on the market, the small incremental improvements in operating costs (average $0.02-$0.06 cost per mile savings) do not equate to total lifetime net savings when the additional incremental cost for hybrid vehicles is factored in. Although HEVs are often more expensive than similar conventional vehicles, some cost may be recovered through a combination of fuel savings, a light-duty HEV federal tax credit, and state incentives. Therefore, Clean Fuels Ohio recommends the City continue to incorporate hybrid vehicles into its fleet whenever the lifecycle costs (including all available subsidies) are less than the lifecycle costs of conventional vehicle models.

Vehicle	Annual Fuel Use	Annual Electricity Use	Annual Fuel/Elec Cost	Annual Operating Cost	Cost Per Mile	Annual Emissions (lbs CO2)
2011 Toyota Highlander 4WD Gasoline	613 gal	0 kWh	$2,121	$4,378	$0.37	14,711
2011 Toyota Highlander Hybrid 4WD Hybrid	426 gal	0 kWh	$1,474	$3,731	$0.31	10,222
2010 Toyota Camry Gasoline	448 gal	0 kWh	$1,550	$3,808	$0.32	10,752
2010 Toyota Camry Hybrid	355 gal	0 kWh	$1,230	$3,488	$0.29	8,532
2011 Ford Escape 4WD Gasoline	520 gal	0 kWh	$1,799	$4,056	$0.34	12,477
2011 Ford Escape Hybrid 4WD Hybrid	422 gal	0 kWh	$1,460	$3,718	$0.31	10,130
2011 Ford Focus FWD Gasoline	407 gal	0 kWh	$1,408	$3,665	$0.31	9,765
2011 Toyota Prius Hybrid	242 gal	0 kWh	$837	$3,095	$0.26	5,807

Key Recommended Action: *Continue to Incorporate Hybrids when Cost Effective*

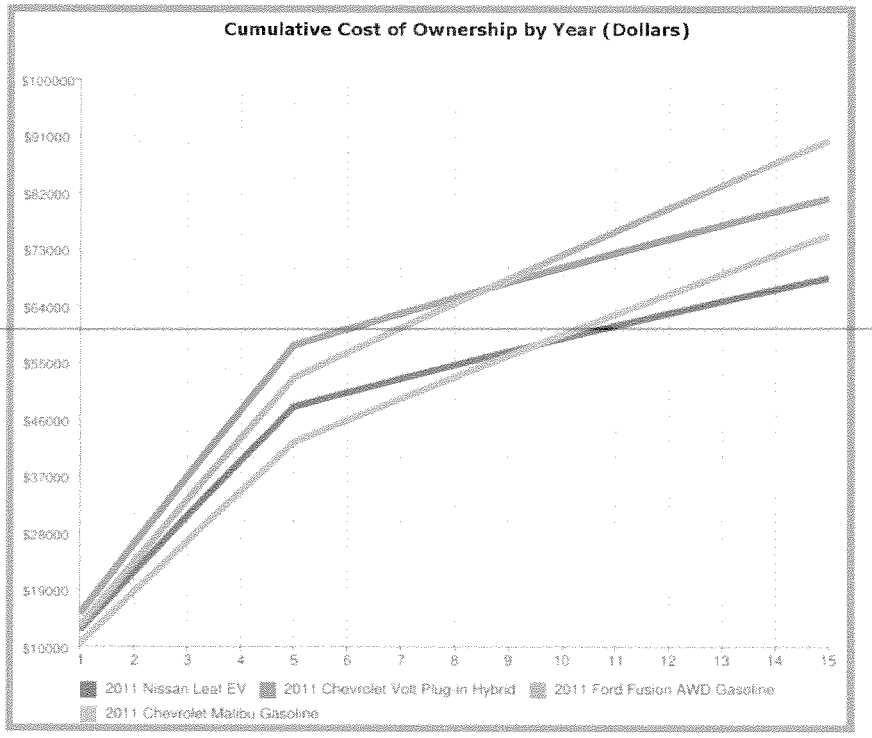
8. ***Acquire energy efficient and alternative fuel vehicles whenever the lifecycle costs (including all available subsidies) are less than the lifecycle cost of conventional vehicles.***
   f. Continue to incorporate hybrid vehicles into its fleet whenever the lifecycle costs (including all available subsidies) are less than the lifecycle costs of conventional vehicle models.

Plug-In and Dedicated Electric Vehicles:

All-electric vehicles (EVs) and Plug-in electric vehicles (PEVs) use a battery to store the electrical energy that powers the motor. EVs are sometimes referred to as battery electric vehicles (BEVs). EV batteries are charged by plugging the vehicle into an electric power source. Although electricity production might contribute to air pollution, the U.S. Environmental Protection Agency categorizes all-electric vehicles as zero-emission vehicles because their motors produce no exhaust or emissions. Because EVs use no other fuel, widespread use of these vehicles could dramatically reduce petroleum consumption.

Heavy-duty electric vehicles are now available, and a few light-duty EVs are also commercially available. Currently available EVs have a shorter range per charge than most conventional vehicles have per tank of gas, with manufacturers typically targeting a minimum range of 100 miles. Although EVs are more expensive than similar conventional and hybrid vehicles, some costs can be recovered through fuel savings, a federal tax credit, or state incentives. As the tables below demonstrate, current commercially available EV models are quickly becoming cost effective, even resulting in lifetime savings if vehicles receive continued use beyond 10 years.

Vehicle	Annual Fuel Use	Annual Electricity Use	Annual Fuel/Elec Cost	Annual Operating Cost	Cost Per Mile	Annual Emissions (lbs CO2)
2011 Nissan Leaf EV	0 gal	4,148 kWh	$437	$2,542	$0.21	8,022
2011 Chevrolet Volt Plug-in Hybrid	72 gal	3,295 kWh	$596	$2,854	$0.24	8,099
2011 Ford Fusion AWD Gasoline	588 gal	0 kWh	$2,034	$4,292	$0.36	14,109
2011 Chevrolet Malibu Gasoline	442 gal	0 kWh	$1,528	$3,786	$0.32	10,601



Key Recommended Action: *Incorporate Electric Vehicles whenever Cost Effective*

8. ***Acquire energy efficient and alternative fuel vehicles whenever the lifecycle costs (including all available subsidies) are less than the lifecycle cost of conventional vehicles.***
   f. Begin to incorporate electric vehicles into its fleet whenever the lifecycle costs (including all available subsidies) are less than the lifecycle costs of conventional vehicle models.

Maximize Incentives – Pursue Federal, State, and Local Subsidies:

Securing funding is often critical to the success of efforts to reduce petroleum use and vehicle emissions in fleet operations. For the past several years, funding opportunities for a wide range of fleet vehicles and refueling facilities have been regularly offered through both state and federal agencies. Depending on the agency issuing funds, eligible projects can include emissions retrofits, fuel and engine repowers, vehicle replacements, idle reduction technology, battery electric vehicles, hybrid electric vehicles, compressed natural gas, propane, biodiesel and other alternative fuel powered vehicles and refueling infrastructure.

Over the past three years, the City of Cincinnati has received several major grant awards by partnering in collaborative applications submitted by Clean Fuels Ohio. The table below details the recent grant awards, federal funding amounts and information on the scope of projects.

Recent Fleet Grant Success: City of Cincinnati

Year	Funding Agency	Award Amount	Project Details
2009	US DOE	$122,000	Funding to cover the incremental cost of 7 Propane F250 trucks, 3 Propane F350 trucks, 2 hybrid SUVs and 6 hybrid passenger cars for City fleet operations.
2010	US DOE	$136,820	Funding to cover the incremental cost of 5 Propane cargo vans, 3 Propane 15 passenger vans, 4 Propane F350s, 1 hybrid SUV and 3 hybrid cars for City fleet.
2011	US EPA	$117,811	Funding to cover the full cost of retrofitting 8 City refuse trucks with Diesel Particulate Filters (DPFs) and the purchase of a cleaning system for the DPF units.
2011	US DOE	$105,000	Funding to cover the incremental cost of 6 Propane E350 cargo vans and 4 Propane E250 cargo vans for City fleet operations.
Total Recent Awards			**$481,631**

Though funding levels for such programs are likely to decrease in the near term, especially on the federal level, many programs will nonetheless continue to be offered. In fact, the state of Ohio will offer two programs for 2012 and 2013 that may help the City acquire additional alternative fuel vehicles and station infrastructure. Clean Fuels Ohio has already begun discussions with the Department of Public Services around projects and plans for submission to these programs. While the official solicitations and

subsidy levels for these state grant programs are still pending, the following table summarizes the most recent information available on the two programs.

State Grant Opportunities: FY 2012-2013	
Ohio EPA Diesel Emission Reduction Grant (DERG)	**Alternative Fuel Transportation Grant (AFTG)**
Funding Level: $10 million available per year	**Funding Level:** $750,000 available per year
Program Parameters:	**Program Parameters:**
Eligible entities include all public fleets and private fleets (with a public sponsor) who operate vehicles in Ohio's air quality non-attainment and maintenance counties. The program is designed to fund retrofits, repowers, and replacements of diesel vehicles and equipment with new cleaner diesel technology, emissions control equipment, or alternative fuels. A solicitation offering $10 million in funding is expected to be released by the Ohio EPA in early December 2011 with a deadline for application by the end of January 2012.	This grant program was originally designed to provide funding for retail stations to install biofuel blender pumps (B20+ biodiesel and E85 ethanol). The program has been expanded to include all alternative fuel refueling infrastructure available for public access, including biofuels, propane, CNG and electric vehicle charging. The State Energy Office is currently finalizing the parameters, subsidy levels, and eligibility requirements for this program. Past program offerings have had a rolling deadline until funds are exhausted.
Submission Assistance:	**Submission Assistance:**
Clean Fuels Ohio has partnered with MORPC and the Ohio Air Quality Development Authority and will be submitting collaborative applications to this program on behalf of statewide fleets. City governments are also eligible to submit stand alone applications for funding.	Past iterations of this program have not allowed third parties to submit applications on behalf of other organizations. However, Clean Fuels Ohio has provided in depth consultation to several past program award winners and is will continue to provide consultation where requested.

Based on recent successes with federal grant awards and the availability of future state grant programs, Clean Fuels Ohio recommends the City of Cincinnati actively pursue all available state and federal subsidies. In particular, CFO recommends the City target the 2012 DERG program to apply for additional propane powered vehicles to replace existing medium duty diesel vehicles in the current fleet. In addition, if during Phase II the City determines to pursue CNG vehicle and station projects, both the programs above may assist the City in acquiring vehicles and refueling infrastructure. As stated above, Clean Fuels Ohio has assisted the City in securing grant funding over the past three years and will be willing to work with Cincinnati to apply for all available opportunities.

Key Recommended Action: *Pursue All Available Subsidies and Incentives*

9. ***Pursue State and Federal incentives, subsidies and grant programs to help reduce the implementation costs of strategies and technologies outlined above***
    a. Apply for 2012 Ohio EPA DERG funding for additional propane powered vehicles to replace existing medium duty diesel vehicles in the current fleet.
    b. Apply for 2013 grant programs to help cover the costs of CNG station and vehicle projects.

Long Term Planning – Develop Multi-Year Strategic Green Fleet Plan:

Transitioning a vehicle fleet to cleaner, more efficient and alternative fuel vehicles is not a simple short term undertaking; nor is moving from more traditional fleet maintenance models to more proactive fleet management strategies that focus on fleet rightsizing, training, tracking, efficiency and cost controls. With average vehicle and equipment replacement cycles ranging from 5-15 years, the need for a multi-year, long term plan is essential. Many organizations set internal goals and priorities for action, but without a detailed implementation plan, and associated policies and procedures to ensure success, little is ultimately accomplished. Industry and public sector best practices reveal that the most successful fleet transitions have been aided by detailed plans that have been implemented over a multi-year timeframe. The table below summarizes some of the planning and implementation milestones which have led the City of Columbus to gain national recognition.

Case Study: City of Columbus Green Fleet Action Plan Timeline & Successes	
• *Mayor Coleman released the Green Memo in January of 2005. This memo outlined various goals and policies to serve as a catalyst for new environmental changes within city government.*	
• *Specifically for Fleet: Reduce or eliminate unnecessary vehicle emissions, reduce fuel usage, reduce dependency on petroleum fuels and right-size the fleet.*	
• *City-wide Anti-Idling Policy became effective in December, 2005.*	
• *2008, Mayor Coleman issued the Green Fleet Action Plan drafted by Fleet Management.*	
Implementation:	
***Technology to reduce emissions**—115 vehicles retrofitted with DOCs or DPFs by end of 2010.*	***Biodiesel**–In 2010, 68% of the City's bulk diesel purchases were biodiesel.*
***CNG vehicles**—1st CNG rear loader put into service in 2009- 22 more heavy duty CNG vehicles and a 6 pump fast fill station by end of 2011.*	***"Green" Vehicles**—Increase purchase of environmentally preferable purchasing policy gives preference to vehicles with a "green" element.*
Results and Recognition:	
• ***September 2011:** Clean Fuels Ohio Certifies Three Divisions as Ohio Green Fleets*	
• ***October 2011:** 100 Best Fleets Competition Recognizes City of Columbus as #1 Government Green Fleet in North America at the national Green Fleet Conference in Dallas, TX.*	

Clean Fuels Ohio recommends the City of Cincinnati develop a green fleet strategic plan outlining a detailed implementation schedule over short, medium, and long-term timeframes to ensure fleet success. This second phase of planning should include a detailed examination of vehicle and fuel options along with additional financial and management strategies designed to achieve the City's goals. In addition, Phase II should outline a detailed implementation schedule over the 13-year period and included the adoption of policies and procedures to ensure fleet success.

Key Recommended Action: *Develop a Detailed Multi-Year Green Fleet Action Plan*

10. ***Develop a green fleet strategic plan outlining a detailed implementation schedule over short, medium, and long-term timeframes to ensure fleet success.***